All contributions to be sent to the Editor, 29 St. Andrew's Mansions, Dorset Street, W.1.

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## EDITORIAL.

IT is sincerely to be hoped that the negotiations toward a diploma in anæsthetics which are now afoot may be brought to a satisfactory end by the establishment of such a distinction. When that comes about anæsthetists will have much to be grateful for to the Association which has taken the initiative in this matter. Much trouble has already been taken, and we know that a deal more still awaits those members of the Council of the Association who are the chief actors in the movement for a diploma. It is obvious that many considerations must be carefully gone into before a new step of this kind can be firmly taken. To mention only one, should the Association seek powers itself to grant a diploma, or should it seek to get a diploma instituted by one of the great examining bodies of Great Britain, one of the old Universities, or of the Royal Colleges? Then, again, the extent and kind of the demands to be made of candidates are subjects of nicety and importance. For ourselves we believe that the requirements of the diploma should not be too exacting. We believe that the great advantage of its institu-

tion would be to enable those within and those without the medical profession to recognise at a glance the persons who had obtained special experience and had become competent anæsthetists. We do not believe the diploma should be reserved for the so-to-speak super-anæsthetist. Any limitation of it in this way would greatly diminish its value, which will, on the other hand, be very real if it enables the public to distinguish, as now it cannot, those who are genuine anæsthetists from those who are that in name alone.

## THE JOURNAL'S PRIZE ESSAY

THE judges have awarded the prize to Doctors Wesley Bourne and B. B. Raginsky, of Montreal, for the essay which they sent in jointly. It is entitled "Vinyl Ether (Vinesthene) Anæsthesia in Dogs: Effects upon Normal and Impaired Liver."[1] The judges report that owing to the excellence of the competing contributions they had difficulty in arriving at their decision, which was, however, eventually unanimous. They would have been happier, perhaps, if the winning essay had been of a nature to be of greater clinical or practical benefit than is the contribution of Wesley and Bourne. The exact nature of the subject-matter was, however, only one of the considerations to be taken into account in awarding merit, and those essays which in this particular were preferred to the winner were too far behind in other respects to displace it. We beg to offer our warmest congratulations to the winners, and to the other competitors the assurance that we shall have the pleasure of publishing their papers in future issues of the journal. Dr. Wesley Bourne is, we are sure, well known personally to many of our readers who met him when he visited this country a few years back, and those who do not know him in this way have probably read with admiration his numerous contribution both to the clinical and the physiological side of our speciality. In several of these he has worked in association with Dr. Raginsky.

[1] The essay is printed at p. 62.

# THE TECHNIQUE OF NERVE BLOCKING FOR VARIOUS ORTHOPÆDIC OPERATIONS.*

By JOHN S. LUNDY, M.D., and RALPH M. TOVELL, M.D.

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ORTHOPÆDIC operations are particularly suitable for methods of nerve blocking or local anæsthesia. This is especially true when the operation is on an extremity or on the spinal column. The drug ordinarily used, and which is without doubt the best one available to-day, is procaine. In nerve block, when small quantities are to be used, a 1 per cent solution is usually chosen. When field block is to be carried out, 0.5 per cent procaine solution is used and, in brachial plexus block, a 2 per cent solution is used. In all injections except those of the digits, 1 c.c. of epinephrine (1 : 2600) is added to 50 c.c. of 2 per cent solution, or to 100 c.c. of 1 per cent solution, or to 200 c.c. of 0.5 per cent solution.

In almost all cases there is usually time to administer some preliminary medicament. Our personal preference is to give morphine and a barbiturate to the average adult and the barbiturate alone to children. To the adult we like to administer 1½ grains (9.097 gm.) of pentobarbital sodium (nembutal) by mouth at bedtime the night before operation, the dose being repeated in the morning when the patient awakes, and a hydodermic injection of $\frac{1}{6}$ grain (0.01 gm.) of morphine and 1/150 grain (0.00043 gm.) of atropine about 45 minutes before operation. For certain nervous individuals, however, the pre-operative dose of the barbiturate should be doubled. There is a distinct advantage in allaying apprehension and fear and in giving the patient a good

*Read before the Gogebic County Medical Society, Ironwood, Michigan, August 16th to 17th, 1934.

night's sleep before the operation. The barbiturate is hypnotic and antispasmodic in its effect and morphine is analgesic, and the steps of nerve blocking are less painful than they would otherwise be. The patient is also protected to some extent against the convulsive effects of intravenous administration of the local anæsthetic or its rapid absorption into the blood-stream in toxic quantities. When there is a marked effect from preliminary medication, there is some amnesia regarding events in the operating room.

In some cases time does not permit administration of these drugs in the usual way. For example, in cases of fracture in which the need for relief is urgent, one may administer morphine intravenously and, if a soluble barbiturate is at hand, it too may be given intravenously. If only the tablets or capsules are available and the patient is unable to swallow, they may be administered rectally, just as one inserts a suppository. Some prefer to dissolve the material and give it in enema form, but that is unnecessary. For the transportation of a patient with a fracture, a barbiturate given by rectum may be used to ease the strain and pain of the journey. It will be necessary to give a sufficient dose to produce a marked effect—that is, an effect equivalent to that produced by alcohol when it becomes difficult or impossible to arouse the individual who has consumed it.

In connection with barbiturates, it is of interest that a new one has recently been introduced; it may be given intravenously for short operations and the period of recovery is short. This drug is called evipan soluble (evipan). We have had our best results with it by administering $\frac{1}{6}$ or $\frac{1}{4}$ grain (0.010 or 0.016 gm.) of morphine intravenously and, in five or ten minutes, by following this with an intravenous injection of from 5 to 15 grains (0.325 to 0.97g gm.) of the evipan. For example, we have used it for the manipulation of the wrists in the presence of some fixation of them, and the patient has been able to return home one or two hours afterwards, as there seems to be practically no sweating, nausea, or prostration following the use of this agent in a small dose.

In cases in which some local anæsthetic agent is used, respiration is usually quiet and there is little prostration during or after operation. Moreover, the operative area is less bloody than when a general anæsthetic agent alone is used.

### Upper Extremity.

Any of the digits of the upper extremity may be anæsthetized easily by injecting from skin to bone around the digit about a finger's breadth proximal to the field of operation (Fig. 1).

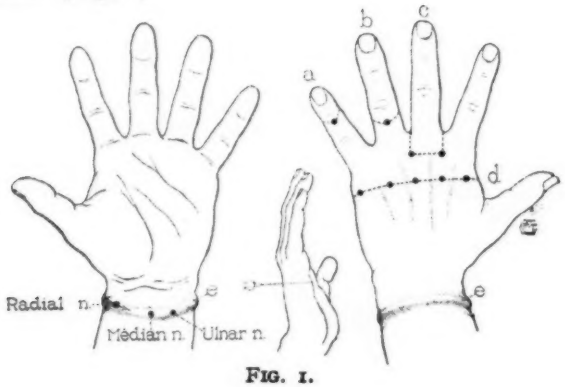


Fig. 1.

Brachial plexus block (Fig. 2) produces anæsthesia of the entire extremity for parts of the skin near the shoulder that are innervated by the intercostal nerves, so that in some cases it is advisable to make an intradermal and subcutaneous bracelet injection with 0.5 per cent procaine solution between the site of operation and the axilla or shoulder. This form of anæsthesia is very useful, but the frequency with which one may fail to produce anæsthesia has discouraged some in the use of the method. One of the most frequent causes of failure, no doubt, is an attempt to produce anæsthesia quickly, not allowing a sufficient interval of time to elapse between the injection and the beginning of the operation for the appearance of anæsthesia. In certain operations, for example, when tendons in the

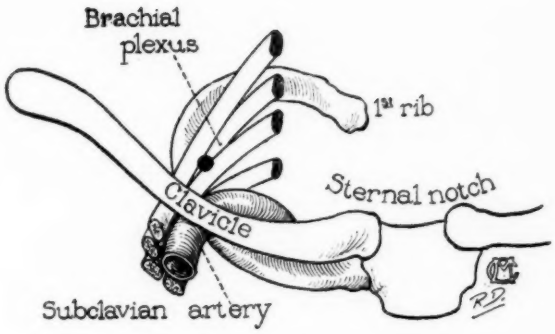
Brachial plexus
1st rib
Sternal notch
Clavicle
Subclavian artery

FIG. 2.

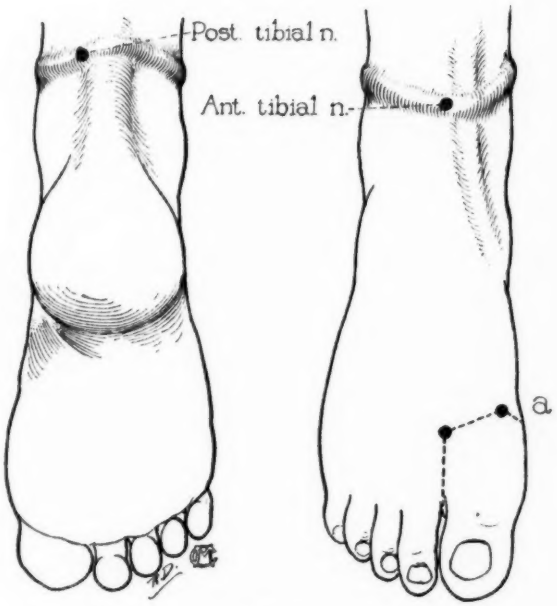
Post. tibial n.
Ant. tibial n.
a

FIG. 3.

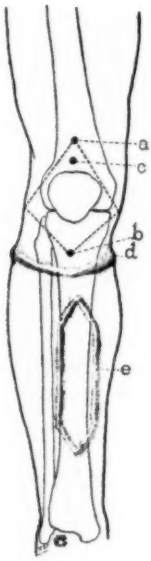


FIG. 4.

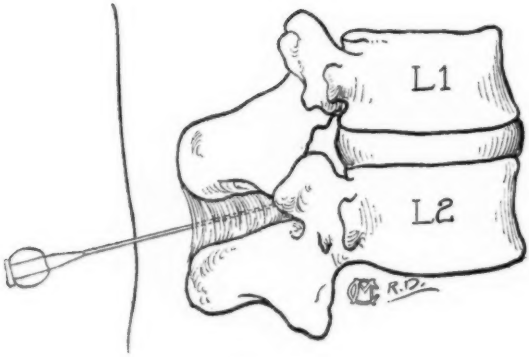


FIG. 5.

forearm have been severed and must be united, and the operation is to be a long one and a general anæsthetic is to be avoided, it is well at least to attempt to block the brachial plexus. This has been particularly advantageous because the patient can respond to directions, such as asking him to move a certain finger, which frequently has helped to identify a given tendon.

### Lower Extremity.

Anæsthesia for operation on the digits of the lower extremity is produced in the same manner as for that on the digits of the upper extremity. It is interesting that, although routine methods of anæsthesia are intentionally avoided in most instances, the only orthopædic operation done as a routine under local anæsthesia at the Mayo Clinic is the Mayo operation for bunion. The technique for injection is given in Fig. 3.

Anæsthesia has been satisfactory for operations on the cartilages of the knee when the method shown in Fig. 4 has been followed for blocking the nerves in that area.

For operations such as amputation of all or part of the leg for gangrene, it is often preferable not to block even near the site of operation; accordingly, spinal anæsthesia is often used. Following spinal injection, a fractured pelvis may be treated, or any operative work from the tenth dorsal vertebra downward may be accomplished. (Fig. 5).

### Fractures.

In cases of fracture, anæsthesia may be produced if the periosteum involved in the fracture and the soft parts adjacent to it are infiltrated with procaine solution. (Fig. 6).

### Spinal Column.

Such an operation as laminectomy or the Hibbs operation may be done with little, if any, pain, following paravertebral and field block. (Fig. 7). One advantage of this block is that the operative field is less bloody after injection than if an injection had not been done.

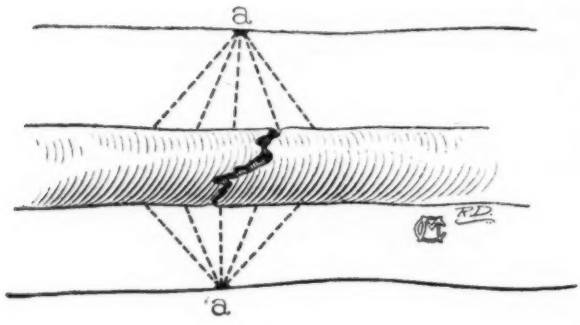


FIG. 6.

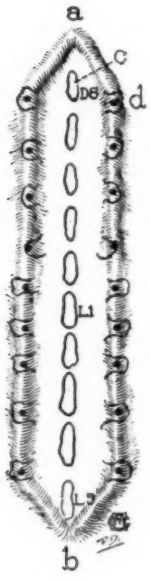


FIG. 7.

Paravertebral block may be accomplished from the second cervical nerve to the fifth sacral nerve, so that almost any level of the spinal column may be anæsthetized. The second, third, and fourth cervical nerves are more easily anæsthetized from the lateral approach than from the posterior approach. More experience is necessary to success in paravertebral block than in any of the other kinds of block anæsthesia that have been mentioned.

LEGENDS.

FIG. 1. (*a*) Dorsal view of the little finger. Operation on the distal digit. A wheal is raised on the dorsum of the little finger, at a point about a finger's breadth proximal to the field of operation, and infiltration from skin to bone is accomplished two-thirds of the distance around the finger using about 5 or 10 c.c. of 1 per cent procaine solution. (*b*) The third finger shows the block for operation farther back of the finger. (*c*) The middle finger shows the block far enough back so that even a disarticulation at the metacarpophalangeal joint may be done. (*d*) If the four fingers of the hand are to be anæsthetized, the injection (*d*) is done. One injects from the skin of the dorsal surface to the skin of the palmar surface directly through the hand, as shown in the insert. The dotted line (*d*) shows an intradermal and subcutaneous injection across the dorsum of the hand. (*e*) If one desires to anæsthetize the entire hand distal to the wrist, a bracelet-like injection is accomplished. The intradermal and subcutaneous part of the injection encircles the wrist, while the deep part of the injection includes the radial, median, and ulnar nerves. One per cent procaine solution is used for the deep part of the injection, the sites for which are indicated, and 0.5 per cent procaine solution for the superficial part of the injection.

FIG. 2. Brachial plexus block with patient in supine position with arms at sides, head half turned to the opposite side. The landmarks that are of value are the sternum, the sternal notch, the midpoint of the clavicle, the first rib, the subclavia artery, and the external jugular vein. A wheal is raised about a finger's breadth above the midpoint of the clavicle and lateral to the subclavian artery and external jugular vein. The needle is inserted through the wheal down to the first rib. If paræsthesia of the arm or hand occurs, the needle is stopped and an injection of 15 to 20 c.c. of 2 per cent procaine solution is made. If paræsthesia does not occur in feeling with the needle for the first rib, the needle is withdrawn until its point is subcutaneous, and it is then directed toward the subclavian artery and again advanced, but not deeper than the first rib. It may be necessary to direct the needle in slightly different directions to obtain

paræsthesia to the hand or arm. Solution may then be injected at the point where paræsthesia is produced, and anæsthesia will develop in 10 or 15 minutes. If paræsthesia is not produced, 10 to 20 c.c. of 2 per cent procaine solution is deposited just lateral to the subclavian artery near the midpoint of the clavicle, and frequently anæsthesia is produced. If the operation is high in the arm, it may be advisable to make a bracelet-like injection, intradermally and subcutaneously around and under the arm near the shoulder, for the purpose of blocking some of the intercostal nerves as they end in the upper part of the arm.

FIG. 3. The block for the Mayo operation for bunion. A wheal is raised about 50 mm. directly posterior to the space between the second and great toes on the dorsal surface of the foot, and an injection of 1 per cent procaine solution with epinephrine is made from the skin of the dorsal surface to the skin of the plantar surface, as shown by the dotted line and in the insert in Fig. 1. The injection is then carried to the inner side of the foot, injection from skin to bone. Some solution is deposited near the distal end of the plantar surface of the first metatarsal bone. A bracelet-like injection of 0.5 per cent procaine solution with epinephrine (*b*) at the ankle is made when the entire foot is to be anæsthetized. Points are indicated for injection of the anterior and posterior tibial nerves with 1 per cent procaine solution with epinephrine. A block similar to that of the great toe may be applied for operations on the thumb.

FIG. 4. A triangular area is blocked off in the dorsal surface around the knee, by injecting 0.5 per cent procaine solution with epinephrine from skin to bone from points (*a*) and (*b*) to points just about lateral to the knee-joint. At (*c*) the needle is thrust from skin to bone and toward the knee-joint, and some of the same solution is injected some of which finds its way into and around the joint and subpatellar bursæ. If the operation is to be done below the knee, the leg, ankle, and foot may be blocked by injecting 0.5 per cent procaine solution with epinephrine, as shown at (*d*), from skin to bone around the leg below the knee. The field block (*e*) represents an area blocked off with 0.5 per cent procaine solution with epinephrine on the anterior surface of the tibia for removal of a bone splint. This injection is made from skin to bone and surrounding the area illustrated.

FIG. 5. A relatively fine or small-gauge needle is used for spinal block. The lumbar puncture is made by directing the needle between the spinous processes and through the dura. A small dose of 10 per cent procaine solution is diluted in the syringe with spinal fluid and the solution injected. The body is anæsthetized below the level of the injection and for a short distance above it, and various operations on the pelvis or lower extremities may be performed painlessly. Since operation is done quickly, a small dose of procaine is usually sufficient. This form of anæsthesia is usually satisfactory with little if any untoward reaction.

FIG. 6. Infiltration of 0.05 per cent procaine solution with epinephrine from skin to the fracture in the bone. This infiltration may be accomplished with little difficulty and is efficacious in producing relaxation as well as anæsthesia. From 20 to 30 c.c. of 1 per cent procaine solution with epinephrine should be deposited against the periosteum where it is lacerated.

FIG. 7. Paravertebral and field block for laminectomy or the Hibbs operation. A few lumbar and dorsal vertebræ are shown. Each heavy black dot represents a wheal through which a needle is thrust. The needle is passed perpendicular to the skin and its point comes to rest on the transverse process of the vertebra. The needle is then partially withdrawn and directed upward over the upper border of the transverse process. A few cubic centimetres of 1 per cent procaine solution is injected around the nerve as it emerges from the intervertebral foramen. Each dot is connected with the one above or below it by an injection of 0.5 per cent procaine solution, which is both dermal and subcutaneous, and is carried down to the level of the transverse processes. The field block on each side is carried upward to points (*a*) and (*b*) so that skin clips may be anchored at those points. The important landmarks in paravertebral block are the spaces between the tips of the spinous processes. The tip of the finger finds a space, and a wheal is raised directly opposite the finger and about 4 cm. from the median line. In the dorsal region a wheal is raised opposite the upper border of the finger (the lower border of the spine of the vertebra above). For example, the lower border of the spinous processes comes just opposite the point where the wheal is to be raised. In the lumbar region the wheal is raised opposite the centre of the interspinous space.

# VINYL ETHER (VINESTHENE) ANAESTHESIA IN DOGS:

## Effects upon Normal and Impaired Liver.*

By WESLEY BOURNE and BERNARD B. RAGINSKY,

*Department of Pharmacology, McGill University, Montreal.*

THAT vinyl ether possesses anæsthetic properties was first demonstrated by Leake and Chen.[1] Their material was impure. Later, using a pure product prepared for them by Ruigh and Major,[2] Knœfel, Guedal and Leake[3] found vinyl ether to be preferable to chloroform and ethyl ether. Two years later they[4] reported their findings in more detail. They state that dogs are more easily anæsthetized with vinyl ether than with ethyl ether when the drop method is employed, that there is less struggling and excitement, and less mucous secretion. They state also that recovery takes place more quickly, that nausea and vomiting are less marked than in the case of ethyl ether, and that there are no significant pathological effects on the various organs. This superiority of vinyl ether appeared to be most striking when it was given with oxygen.

About the same time, Gelfan and Bell[5] reported a trial of vinyl ether upon themselves. They felt it to be worthy of clinical use.

Goldschmidt, Ravdin, Lucke, Muller, Johnston and Ruigh[6] have made extensive physiological, pathological and clinical studies on the dog, monkey, and man. They have shown from determinations of the concentrations in the blood necessary to produce anæsthesia that the anæsthetic potency of vinyl ether is four times that of ethyl ether and one and three-tenths greater than that of chloroform. At the same time there is a wider "margin of safety" between

* The Vinyl Ether was supplied by Merck and Co. Ltd.

the anæsthetic and the lethal concentrations of vinyl ether in the blood as compared with those of ethyl ether and chloroform. These observers report liver necrosis in dogs after vinyl ether has been given for three hours; none was found in monkeys.

One of us[7] reported the successful use of vinyl ether in 152 cases of obstetrics. In four of these the bromsulphalein test[8] showed that there was practically no liver damage.

However, it seemed desirable to us to study the actions of vinyl ether upon the liver more thoroughly. Accordingly, it was administered to normal dogs, to dogs with damaged livers, and to partially starved dogs, and the liver function measured.

*Normal dogs.* Vinyl ether was administered to three by pharyngeal insufflation, to two by intratracheal insufflation, and to six in a glass cabinet through which air containing vinyl ether vapour was blown (this method was the most satisfactory). The substance was administered for varying periods of time, as shown in Table I. The bromsulphalein liver function test was carried out according to the method of Rosenthal and White[8] on successive days following the administration of the anæsthetic. In several instances the administration of vinyl ether was repeated after the liver function test was completed and further determinations of liver function were made. In four instances it was administered for the third time, with subsequent application of the dye test.

The data are given in Table I, which can best be explained by describing one typical case. Dog No. 16 was anæsthetized with vinyl ether in the cabinet for one hour; 24 hours later the liver function test was carried out and 10 per cent dye retention in the blood was found. The following day the animal was again anæsthetized in exactly the same manner, it being considered unnecessary to measure liver function. Twenty-four hours later the liver function test was done again and resulted in a 5 per cent dye retention. The same day, following this second test, the dog was anæsthetized for the third time for one hour, and 24 hours later the function of the liver was again determined, showing no dye retention 15 minutes after injection of the dye.

TABLE I.
NORMAL DOGS.

| Dog number | Method of induction | Duration of anæsthesia in hours | % Dye retention. Days later | | | Duration of anæsthesia in hours | % Dye retention one day later | Duration of anæsthesia in hours | % Dye retention. Days later | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | | | | 1 | 2 | 3 | 4 | |
| 1 | Pharyngeal | 1 | 10 | 5 | 5 | — | — | — | — | — | — | — | — |
| 2 | Pharyngeal | 1 | 10 | 5 | — | 1 | 5 | — | — | — | — | — | — |
| 17 | Cabinet | 1 | 0 | 0 | — | 1 | 5 | — | — | — | — | — | — |
| 18 | Cabinet | 2 | 15 | 5 | — | 2 | 10 | — | — | — | — | — | — |
| 3 | Intratracheal | 1 | 30 | — | — | 1 | — | 1 | 100 | — | 30 | 0 | Cyanosis marked: considerable mucus |
| 4 | Intratracheal | 1 | 10 | — | — | 1 | 10 | — | — | — | — | — | — |
| 5 | Pharyngeal | 1 | 10 | — | — | 1 | 5 | — | — | — | — | — | — |
| 14 | Cabinet | 1 | 10 | — | — | 1 | 0 | 1 | — | — | — | — | Died 15 minutes later (autopsy: dilated stomach) |
| 15 | Cabinet | 1 | 5 | — | — | 1 | 0 | 1 | 5 | — | — | — | — |
| 16 | Cabinet | 1 | 10 | — | — | 1 | 5 | 1 | 0 | — | — | — | — |
| 19 | Cabinet | 3 | 5 | — | — | 1.5 | — | — | — | — | — | — | Died during administration of anæsthetic |

Dog No. 3 showed considerable cyanosis during the anæsthesia, which is reflected in the high dye retention (30 per cent retention 24 hours following the first administration). Vinyl ether was given twice again on successive days for a period of one hour at a time, and liver function determinations were made following the last administration. There was found to be 100 per cent dye retention 24 hours later, 30 per cent 72 hours later, and no dye retention after 96 hours. These results, though not at all typical of the group, show that even in extreme cases recovery of liver function takes place fairly rapidly.

Dog No. 14 was anæsthetized on three successive days for a period of one hour each day. The liver function test revealed a 10 per cent dye retention 24 hours after the first day and no dye retention after the second administration. However, 15 minutes after the last anæsthesia the dog was found dead in its cage, having been placed there in good condition five minutes previously. An autopsy performed immediately thereafter showed a greatly dilated stomach only. We are at a loss for an adequate explanation for the immediate cause of death, aside from the autopsy findings. We do feel certain, however, that it was not due to any liver damage.

In the case of dog No. 19, three hours of vinyl ether anæsthesia in the cabinet was followed in 24 hours by a 5 per cent dye retention. An attempt was made to repeat the anæsthesia for another three hours on this day, but the animal died after one and a half hours of anæsthesia and could not be revived. This type of death occurred quite frequently during our first experiments with the vapour and before we became a little more accustomed to its use in dogs.

The data in Table I tend to show that vinyl ether anæsthesia administered to dogs for periods of one hour or more on three successive days does not alter the liver function appreciably. In those cases where cyanosis is a feature of the anæsthesia, moderate impairment of liver function occurs, but this is not due directly to the drug but to the associated anoxæmia.

*Dogs with damaged livers.* Measured degrees of liver

damage were produced by the administration of chloroform to seven dogs and, at various times during the recovery period from chloroform poisoning, vinyl ether was given to determine whether additional damage to the previously impaired livers occurred.

The results may be found in Table II. Dog No. 6 was anæsthetized with chloroform for 35 minutes, and 24 hours later the 15-minute dye retention was found to be 70 per cent. Immediately thereafter the animal was anæsthetized in the cabinet for one hour with vinyl ether. One day later the dye retention was found to be 90 per cent, three days later 60 per cent, four days later 50 per cent, five days later 25 per cent, and six days later 20 per cent. From the results of a previous study[9] of the effects of chloroform on liver function in dogs, it may be seen that an additional hour of vinyl ether anæsthesia given just before the peak of liver function impairment due to chloroform poisoning does not enhance this damage at the time, nor does it retard the progress of recovery. This point is illustrated more strikingly in the data of the other six experiments shown in this Table.

Repetition of vinyl ether anæsthesia for one hour on successive days, as shown in the case of dog No. 8, did not alter the period of recovery from chloroform poisoning at all.

*Partially starved dogs.* Since the glycogen reserve of the liver is lowered through starvation, four dogs were placed on half rations for three days and then given vinyl ether in order to observe the effects upon glycogen-poor livers. The first dog died after 55 minutes of anæsthesia in the same way as dog No. 19 (Table I). The second dog received vinyl ether for two hours, and on the following successive days the liver function determinations showed the dye retention percentages to be 25, 25, 15 and zero respectively. This experiment was repeated in exactly the same way on the third dog, and there was found to be 10 per cent dye retention after the first day and no dye retention after the second. On the day following, anæsthesia for one and a half hours in the fourth dog resulted in no dye retention, and the anæsthesia was repeated on that day. On the following day there was a 5 per cent dye retention.

TABLE II.

DOGS WITH DAMAGED LIVERS ($CHCl_3$).

| Dog number | Method of induction | $CHCl_3$ Duration of anæsthesia in minutes | $CHCl_3$ % Dye retention. Days later 1 | 2 | $Vi_2O$ Duration of anæsthesia in minutes | % Dye retention. Days later 1 | 2 | 3 | 4 | 5 | 6 | $Vi_2O$ Duration of anæsthesia in minutes | % Dye retention. Days later 1 | 2 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Cabinet | 35 | 70 | — | 60 | 90 | — | 60 | 50 | 25 | 20 | — | — | — | — |
| 8 | Cabinet | 30 | 50 | 20 | 60 | 10 | — | — | — | — | — | 60 | 10 | 5 | — |
| 9 | Cabinet | 30 | 25 | — | 60 | 20 | 10 | 5 | 5 | — | — | — | — | — | — |
| 10 | Cabinet | 40 | 55 | — | 60 | 55 | 35 | 10 | 5 | — | — | — | — | — | — |
| 11 | Cabinet | 40 | 60 | 40 | 60 | 40 | 20 | — | — | — | — | — | — | — | — |
| 12 | Cabinet | 40 | 70 | 50 | 60 | 35 | 15 | — | — | — | — | — | — | — | — |
| 13 | Cabinet | 60 | 80 | 60 | 60 | 40 | 25 | — | 5 | — | — | — | — | — | — |

These observations would indicate that there is no appreciable difference in the effect of vinyl ether upon normal and starved dogs, that is, upon normal and glycogen-poor livers.

*Acute experiments.* Three dogs were anæsthetized intratracheally and kymographic tracings were made of the blood-pressure and respirations to determine accurately whether death from this anæsthetic was respiratory or circulatory in character. After one hour of anæsthesia the concentration of the vapour was increased slowly. Respiration ceased before the heart stopped. Resuscitation of these animals was only occasionally successful.

Two dogs were anæsthetized for a period of one hour each, using oxygen instead of air for vapourizing the vinyl ether. Administration was by means of a gas machine (Foregger) but the exact proportions of the gases were not determined. The anæsthesia produced by this method did not vary in any respect from that produced by vinyl ether and air. The liver function tests in both instances showed no dye retention 24 hours later.

The above facts concerning the effects of vinyl ether on the liver are corroborative of those reported by one of us in obstetrical cases.[7]

We should like to append some comments upon vinyl ether anæsthesia in dogs. The difficulties encountered in anæsthetizing our animals and the poor type of anæsthesia produced in most cases do not correspond with the findings reported by other observers[4, 6] who found smooth and satisfactory anæsthesia to be the rule. On the contrary, we found it almost impossible to abolish the running movements during anæsthesia, and true surgical anæsthesia was seldom produced. We also found it necessary to exert momentary supervision of the anæsthesia in order to prevent death on one hand or awakening on the other. There was no wide margin of safety. However, this is not the case in man, as evidenced by Ravdin and his co-workers[6] and one of us.[7] We regard vinyl ether as much more useful in man than for laboratory purposes.

## Summary.

1. Vinyl ether anæsthesia in normal dogs does not alter the liver function appreciably. In those cases where cyanosis

is a feature of the anæsthesia, moderate liver damage occurs which is not due directly to the drug but to the associated anoxæmia.

2. Vinyl ether anæsthesia does not enhance the liver function damage produced previously by the inhalation of chloroform, nor does it delay the period of recovery from this damage.

3. The effect of vinyl ether anæsthesia upon the liver function in partially starved dogs is not appreciably different from that produced in normal animals.

4. Death in dogs resulting from too great a concentration of the drug is caused through respiratory failure followed closely by failure of the heart.

5. Vinyl ether is an unsatisfactory anæsthetic for dogs.

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# SPINAL ANÆSTHESIA

## (A Criticism)

By E. Falkner Hill.

THE article on spinal anæsthesia in the last number of this journal by Prof. Sebrechts, of Bruges, must have been read with deep interest by all who have any knowledge of the subject. His vast experience of spinal anæsthesia constitutes him one of the great authorities on the matter. Anything that he says is bound therefore to be treated with the greatest respect. He has made many noteworthy statements in the present article, to some of which I propose to draw the attention of the reader. Here is one that will meet with a large concensus of opinion: "I sincerely believe that for most cases of abdominal surgery it is spinal anæsthesia which offers the greatest advantages". That statement might be made in a surgical journal with at least equal appropriateness.

Certain of the views advanced, however interesting and however skilfully presented, are so much at variance with my own experience, both clinical and experimental, that I feel compelled to subject them to critical scrutiny.

"I do not consider it necessary to take the blood-pressure of the patient." If a surgeon be his own anæsthetist it is of course out of the question for him to make frequent blood-pressure observations, but if a trained anæsthetist be available, the regular observation of the blood-pressure gives much valuable information. Not only can the approach of a crisis be seen, and therefore often avoided, but the causes of the variations in the blood-pressure can be determined and much useful knowledge acquired. In this way, for instance, it has been found that the preliminary injection of ephedrine sends up the blood-pressure and seems to keep it up for a considerable period, but if given after the blood-pressure has fallen it seldom succeeds in

raising it. Again, if the preliminary injection of ephedrine does not send up the blood-pressure, there must be some cause for it; that cause is usually ascertainable, and it is obviously desirable that the anæsthetist should know it. I do not see how such knowledge can be obtained without constant and systematic observation of the blood-pressure. It is only by the patient accumulation of such observations that conclusions can be safely drawn. The man who trusts to memory can at best have a vague impression rather than definite knowledge. In a crisis a little definite knowledge is worth more than many vague impressions.

"We do not advise the injection of ephedrine as a preventive measure with the exception of patients who are particularly frail, because it diminishes the quality of the anæsthesia and increases the blood oozing." "On the other hand we are in favour of using ephedrine and preferably adrenalin when really alarming symptoms take place." Pannett, on the other hand, says: "The injection of ephedrine or adrenalin is not recommended." Seevers and Waters use it both prophylactically and therapeutically. I use it only before the spinal anæsthetic is given. I have never found it of use after the blood-pressure has gone down. A fall of blood-pressure may be "even a favourable phenomenon" as it undoubtedly tends to prolong the anæsthesia; at the same time it cannot be denied that in certain cases a profound fall of blood-pressure may contribute to a fatal result. It is quite possible that the preliminary injection of ephedrine might just turn the scale in favour of such a case; it would come into the category of the "particularly frail". If the fall of blood-pressure that occurs during the operation be accompanied by other symptoms of a serious nature and the general picture is alarming, the most effective treatment in my experience is an intravenous injection of saline with pituitrin intramuscularly. A patient whose blood-pressure was only 70 mm. Hg. before the spinal anæsthetic was given and whose radial pulse disappeared in the course of the next 10 minutes, was by these means completely restored; his blood-pressure rose steadily throughout a long operation (80 minutes). At the end it was 120 mm. Hg. A mere fall

of blood-pressure unaccompanied by other untoward signs is, I agree, of no clinical importance, and needs nothing but a slight Trendelenburg position.

Speaking of percaine, Prof. Sebrechts says: "The factor which characterises it and gives it an entirely special place in the series of anæsthetic agents is the intensity and duration of the blockage of the motor fibres." And again: "In spinal anæsthesia without percaine the blockage of the orthosympathetic nerve constitutes the main danger. In spinal anæsthesia with percaine the main danger is the paralysis of the respiratory muscles, whereas the blockage of the orthosympathetic nerve plays a less important part." Once more (referring to the paralysis of the intercostal nerves) he says: "This is a condition frequently seen when one uses percaine, which, as we have said, seems to have a special affinity for the motor fibres. In such cases the patient exhibits that slight degree of cyanosis which is so characteristic of percaine anæsthesia. It is generally necessary to watch the patient, because the diminution of the amplitude of the respiratory movements is a causal factor of circulatory hypotension."

From an earlier paper of Prof. Sebrechts, before he began to use percaine, I take the following extract: "Chose remarquable et curieuse, l'action de l'alcaloide, qui se manifeste successivement par l'abolition de la sensibilité et de la motilité puis par l'abolition des fonctions du sympathique, est de loin la plus intense, la plus étendue et la plus prolongée sur les fibres de la sensibilité; elle est moins intense et s'exerce sur un terri toire beaucoup plus restreint et beaucoup moins longtemps sur les fibres de la motilité; elle est peu étendue et d'assez courte durée sur des fibres sympathiques."

This statement refers, I believe, to the action of novocain. It does not seem to harmonize with "in spinal anæsthesia without percaine blockage of the orthosympathetic nerve constitutes the main danger." Or if it does harmonize, the "main danger" must be very slight. If this is what is meant I am in entire agreement with it.

So far as cats are concerned, we have found it impossible to reduce the blood-pressure below 60 mm. Hg., even with

the enormous dose for a cat of 150 mg. of novocain, provided we have prevented the anæsthetic from reaching the phrenic roots. If the blood-pressure in man goes below 60 mm. Hg. there is probably some other factor playing a part in the fall beside the anæsthetic, or the latter has reached the phrenic roots. If, then, the main danger in spinal anæsthesia without percaine be the blockage of the orthosympathetic nerve, and if this main danger be so slight that it is "peu étendue et d'assez courte durée", it follows that spinal anæsthesia with novocain is a very safe method.

Can this be said of percaine? I believe it perhaps might be, but surely not by the method here advanced. I have no experience of percaine myself, so I am taking Prof. Sebrechts' statements as the true gospel in this matter. What does he say?—

1. "In spinal anæsthesia with percaine the main danger is the paralysis of the respiratory muscles."

2. "This condition (paralysis of the intercostal muscles) is frequently seen when one uses percaine, which, as we have said, seems to have a special affinity for the motor fibres. In such cases the patient exhibits that slight degree of cyanosis which is so characteristic of percaine anæsthesia. It is generally necessary to watch the patient, because the diminution of the amplitude of the respiratory movements is a causal factor of circulatory hypotension."

Surely an anæsthetic whose action is characterized by the intensity and duration of the blockage of the motor fibres, with its consequent intercostal paralysis, suppression of the inspiratory movements of the thorax, weakening cardiac action, cyanosis, and possibly even paralysis of the diaphgram, is one to be avoided. An expert like Prof. Sebrechts, with at least twenty-five years' experience in the much safer school of novocain, may perhaps make the experiment in special cases, and so obtain the advantage of a longer anæsthesia; the complicated technique extending over 35 minutes with the needle in the theca during the movement of the patient from one position to another, together with the aforementioned dangers, would seem to indicate that it is a method that should be reserved for the very special case in the hands of the very special expert.

Our surgeons in Manchester seldom require more than one and a half hours to complete a major abdominal operation, and it is still more seldom that a full dose of the viscous preparation of procaine that I now use does not provide that time. I have seen two cases in which the upper abdomen was the site of an operation lasting just over two hours in which the anæsthesia lasted throughout. This length of time is admittedly exceptional for an upper abdominal anæsthesia. The lower abdomen is as a rule easily anæsthetized for that period as, for example, in an abdomino-perineal section. Apart, then, from the increased length of time given by percaine, which is only occasionally of advantage, there would seem to be many grave disadvantages connected with its use, simply because of the "intensity and duration of the blockage of the motor fibres". The relaxation obtained by the procaine preparation that I use is perfectly satisfactory, and it is difficult to see what more could be desired by the most fastidious surgeon.

"The theory of the primary bulbar accident must be resolutely abandoned. It was formerly thought, and many surgeons still believe to-day, that the syncope and stoppage of respiration in the course of spinal anæsthesia resulted from the impregnation of the vital centres of the bulb by the anæsthetic agent. This opinion is erroneous, as shown by the fact that in animals it is possible to deposit on the bulb a strong anæsthetic solution without causing any circulatory or respiratory trouble."

It is exceedingly probable that in practice, if the anæsthetic goes "too high", the respiratory paralysis that results is a root paralysis of the phrenic roots, and not due to the impregnation of the bulbar centres by the anæsthetic solution. The reason of this is obvious. The injection is given in the lumbar region. As it ascends the theca it will come across the cervical roots before it reaches the bulb; if it paralyses these roots and stops respiration, how is it possible to tell whether it goes on to paralyse the bulbar centres? It is not possible. The experiments of Macdonald and myself, however, show a marked difference in the respiratory record of a cat whose phrenic roots are paralysed by novocain placed under the third cervical vertebra and that

of a cat whose respiration is paralysed by a similar injection of novocain into the *cisterna magna*. We have explained this difference by supposing that the injection under the third cervical vertebra paralyses the phrenic roots and that into the *cisterna magna* paralyses the respiratory centre. If this is not the correct interpretation, we are waiting for it. Until this is forthcoming we believe that an injection of novocain into the *cisterna magna* does paralyse the respiratory centre and not the phrenic roots. We still believe, therefore, in the possibility of the primary bulbar accident, which, however, it would be impossible to distinguish in practice from a preceding paralysis of the phrenic roots. The record of respiration which follows an injection of novocain under the third cervical vertebra resulting in a paralysis of the phrenics is characterized by a steady diminution in amplitude of each respiration. That following a similar injection into the *cisterna magna* is quite different, and is characterized by a marked slowing of respiration with no diminution of amplitude of each respiration.*

"The injection into a vein of 20 c.c. of percaine solution 1 : 1500 without adrenalin causes no disquieting symptoms whatever."

Some of your readers will remember that Dr. Howard Jones, in a paper read at the Eastbourne meeting of the British Medical Association in 1931, said that "The danger is from blood absorption and paralysis of the vasomotor centre, leading in some cases with excessive doses, to severe collapse to a pulseless state." He offered this as the explanation of the precarious state of a child of six to whom 200 mg. of novocain had been given. I pointed out at the time that the facts would not bear this interpretation, and that the bulb was not suffering from novocain poisoning but from anæmia. Moreover, Macdonald and I have shown that, whereas 10 mg. of novocain injected into the *cisterna magna* will cause the death of a cat in one a half minutes by respiratory paralysis, it takes 180 mg. of

* Any one who is interested will find the records of respiration and blood-pressure, upon which the opinions here expressed are based, in my thesis on spinal anæsthesia, now in the Medical Library of the Manchester University. (Figures 5, 8, 9, 10.)

novocain injected intravenously at the rate of 7.5 mg. per minute to paralyse the respiratory centre. There is no evidence that the vasomotor centre has been influenced even by this enormous dose. Again, 300 mg. of novocain is generally considered a full dose for a long abdominal section done under spinal anæsthesia, it will last one and a half hours. Yet if this dose be injected into a vein in the course of ten minutes there is no appreciable effect on either the respiration or the blood-pressure or any subjective symptoms. It is interesting to see that Prof. Sebrechts has found percaine in anæsthetic doses equally innocuous by the intravenous route.

Seeing that percaine in anæsthetic doses, apart from the backache which it appears to cause, seems almost as innocuous as novocain in anæsthetic doses, may not the terrible dangers of which Prof. Sebrechts warns us be due not so much to percaine as to the particular manner in which it is used? If all, or nearly all, these dangers arise from the "intensity and duration of the blockage of the motor fibres" they would be much lessened by using *a heavy solution* of percaine. Under these circumstances, if owing to "human imperfection" too large a dose were given, it would expend itself on the comparatively unimportant posterior roots, so producing a higher anæsthesia than is required, but leaving unscathed those vitally important anterior roots upon which the very life of a patient depends.

I have seen patients whose anæsthesia extended to the territory supplied by the third and fourth cervical nerves, who could move their arms, breathe in comfort, and had no fall, indeed a rise of blood-pressure, when the anæsthetic solution used was heavy and viscous. If 20 c.c. of a 1 : 1500 solution of percaine be used, that means a dose of 13.4 mg. of percaine. If this amount of percaine were dissolved in 3 c.c. of a medium such as is used in the preparation of procaine that I am in the habit of using, it would yield a 0.45 per cent solution of percaine and could be made of a specific gravity of 1.028. Would such a solution be too toxic for the nerve structures with which it came in contact? If not it would be well worth a trial in those occasional cases that are expected to last over one a half hours.

One more point. It is interesting to note that Prof. Sebrechts thinks that headache is more liable to follow spinal puncture for diagnostic purposes than for spinal anæsthesia, and that paralysis of any kind is never caused by the injection of a fluid that is "little irritant". Inexperienced and clumsy operators who damage the nerves of the *cauda equina* will have the great weight of Prof. Sebrechts' authority against them when they incriminate the solution that they are using, rather than their own maladroitness.

It is a great advantage to us in this country to have the privilege of reading anything that Prof. Sebrechts writes on the subject of spinal anæsthesia. Those of us, however, who have read his former paper in the *Bulletin de l'Academie Royale de Medicine de Belgique*, cannot but regret that the well-digested experience, which is so obvious in that paper, and indeed so characteristic of it, gives place to such a temporary and tedious technique as is recommended in this later article.

# GENERAL INTRAVENOUS ANÆSTHESIA WITH EVIPAN-SODIUM.

By Dr. Pasquale Serocca, Naples.

(Translated by George Edwards, M.R.C.S., L.R.C.P.)

*[Concluded]*

Lauber himself has used it extensively in minor surgery and in more extensive operations (sequestrectomy, etc.). Baetzner, in a large surgical experience, has used it for 400 patients suffering from varied diseases, some of them serious. He had no incidents worthy of record. Further, he mentions particularly the case of a patient, aged 15, who had severe hæmorrhage following thrombosis of a vein in the neck due to otitis media. The operation was completed in four minutes, and with a dose of barely 4 c.c. of the anæsthetic. The return to consciousness was rapid and perfectly easy. Sebening and Beck, as we have said before, have also used it for treating patients in extreme pain.

In Italy, the use of evipan-sodium is not widespread. Indeed, only De Gironcoli, who reported his work to the last Italian Surgical Congress, and Sussi, have taken up the use of the drug. De Gironcoli has experimented with it in 108 cases of either sex, and ranging in age from 12 years to 82. Sussi has treated slightly more patients. In eight cases of De Gironcoli's the anæsthesia was inadequate either through incorrect technique or from using too small a dose. The opinions of these two Italian anæsthetists are definitely in full agreement with those of foreign investigators.

With regard to contra-indications, almost all anæsthetists agree that there are none. Lauber, however, thinks that the drug ought not to be used in cases where the liver function is seriously damaged, and that care must be taken in cases of septicæmia, peritonitis, and in ileus, in which condition Baucks has reported two cases of grave circulatory disturb-

ance, which may have been due to the disease itself. He also reports the case of a diabetic patient, almost comatose, who was treated without any disturbance: whilst, on the other hand, Sebening and Beck have had a marked increase in the blood-sugar in their diabetic cases. It must be added, moreover, that in tendon suturing the muscular tension has interfered with the operation. Kaspar has used evipan-sodium in cases where other agents were not permissible (cardiac weakness, tuberculosis, and severe secondary anæmia) and, like Baetzner, has found no reasons for fear in so using it.

## Considerations and Conclusions.

The many experiments made by anæsthetists and the vast amount of evidence available, indicate that evipan-sodium is definitely useful in minor surgery and in the smaller operations of daily practice. It is a safe and largely innocuous addition to the surgeon's pharmacopeia. Wendel thinks that evipan-sodium is the ideal drug for use on ambulatory patients, and, indeed, these patients provide the best field for its use. As a basal anæsthetic, it has been used with success by some anæsthetists; others still prefer avertin for this purpose. If evipan-sodium, however, cannot replace local anæsthesia, it should certainly take the place of ether, which is definitely unpleasant to the patients. As regards the possible disturbance of the respiratory centre (Fründ, 23 cases in 200) investigations show that small doses of coramine or lobeline, if one cannot use carbon dioxide-oxygen mixture, immediately restore normal breathing. Apart from this, no untoward incidents have been ascribed to this anæsthetic.

To conclude, evipan-sodium has been shown to be a drug of wide use. It is completely broken up in the body, is non-toxic in normal doses, and has a particularly rapid action. The technique of infection and estimation of dose do not require either a special experience or training. Recovery is pleasant and uneventful. The records, already sufficiently large in spite of its recent introduction, justify a yet more extensive use of the drug. When dealing with the smaller operations of surgery and with emergency surgery, com-

parison of the new method with the others which have previously been used, tell absolutely in favour of evipan-sodium, which by its peculiar qualities can be hailed as a real discovery in methods of anæsthesia.

## Summary.

The author, after a rapid review of anæsthetics, examines the claims of evipan-sodium, describing its principal characteristics. A review of the experiments, and the results hitherto described, lead him to ascribe great value and importance to this new drug.

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# 250 CASES OF SPINAL ANÆSTHESIA WITH PERCAINE ACCORDING TO THE METHOD OF JONES.

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(*Director*: *Prof. O. Pankow*).

JONES took advantage of two properties of percaine in order to devise a new method of spinal anæsthesia. Percaine, which is characterized by a prolonged action, held out the prospect of *prolonging spinal anæsthesia*, which, with the usual anæsthetic agents, lasted generally about 45 minutes, whereas it was to be anticipated that, with percaine, it would last over three hours. Furthermore, percaine acts in such diluted solutions that only minute quantities of the substance are necessary in spinal anæsthesia; as a consequence of this very high dilution and of the minute quantity of the substance employed only a *very slight general resorption and toxicity* was to be expected. It is well known that on the one hand the rapidity of absorption and the consequent passing of a substance into the organism depend on the concentration of its solution, as compared with the humours of the body, and that, on the other hand, the general toxicity increases in relation to the rapidity of absorption. Furthermore, the fact that minute quantities of the substance cause anæsthesia made it possible to inject percaine into the cerebro-spinal fluid in the form of a solution whose specific gravity is lighter, and this *without the addition of any foreign substance* apart from 0.5 per cent sodium chloride.

Jones devised his method of spinal anæsthesia with percaine on the basis of the above considerations. For general practice *the* 1 : 1500 *percaine solution in* 0.5 *per cent saline* (as marketed by the manufacturers in 20 c.c. ampoules ready for use) is sufficient. This solution has a specific gravity of 0.003 (at 35°C. or 95°F.) and is consequently

*lighter than the cerebro-spinal fluid*, whose specific gravity is 1.006. The said diluted solution causes an anæsthesia of from one to two hours' duration. Symptoms of general toxicity are absent. Jones injects the solution in the lateral decubitus between $L_1$ and $L_2$ with a thin needle, the doses varying according to the desired extent of anæsthesia.

Fifteen to 18 c.c. injected between $L_1$ and $L_2$ will anæsthetize up to between $D_1$ and $D_5$, i.e. the thorax. Twelve c.c. will anæsthetize up to $D_7$ or $D_8$, i.e. the xyphoid process, whereas with 10 c.c. the anæsthesia reaches $D_{10}$, i.e. the level of the umbilicus.

In order to anæsthetize the sacral and coccygeal plexuses Jones injects 6 c.c. between $L_4$ and $L_5$. The injection is made slowly within one to two minutes under gentle pressure without previous elimination of cerebro-spinal fluid. When the patient is in the dorsal decubitus the light percaine solution soaks first of all the anterior motor roots: therefore, in order to block the posterior sensitive roots the patient must be placed on a flat table or on a stretcher in the ventral decubitus for five to ten minutes according to the length of the operation. The arms must be placed under the chest and the head must be bent downwards. The highest point of the spinal canal corresponds to the first dorsal spine, and as the light percaine solution cannot reach the culmination point, one avoids with certainty the rise of the anæsthetic solution to the region of the cervical vertebra. After five to ten minutes the patient is placed on the back in the slight Trendelenburg position, which can be increased if necessary. The object of the Trendelenburg position is not only to fix the light percaine solution caudalwards, but it prevents the tendency to collapse due to paralysis of the vascular system of the lower extremities and of the viscera with concomitant fall of the blood-pressure. Of course, the risk of possible accident increases in proportion to the quantities of anæsthetic solution used, because greater regions of the circulation as well as the thoracic respiration are affected.

The advantages of the method of percaine anæsthesia which we have just described as compared with novocaine and stovaine are the *insignificant general toxicity, the perfect*

*muscular relaxation, the duration of the anæsthesia, the reliability, and the insignificant sequelæ.* Jones considers the main dangers of the method to be the more or less pronounced blockage of the intercostal innervation with consequent over-exertion of the diaphragmatic respiration which causes exhaustion of the respiratory centre; this again causes anoxæmia and increased damage of the respiratory centre, which results in a vicious circle. For this reason Jones deprecates the administration of "twilight sleep" medication as well as the use of narcotics prior to spinal anæsthesia. These agents diminish the excitability of the respiratory centre in general and its power of physiological reaction to $CO_2$; they result in insufficient ventilation of the lungs, central exhaustion, nausea and anoxæmia with progressive fatigue of the mechanism of respiration. The most efficient agent to counteract that condition is the administration of $N_2O + O_2$ with the re-breathing method, i.e. with increased $CO_2$ and abundant $O_2$. We also have used this method with success; the administration of but 50 to 70 per cent $N_2O$ to excited patients induces a quiet sleep with deep respiration. We shall refer later on to the blood-pressure prophylaxis which Jones practises by administering 1 c.c. of ephedrine after the spinal injection.

A survey of the reports published in the literature on the method of Jones shows that 25 authors have reported on over 6,000 cases, of which at least 2,000 refer to high anæsthesia mostly for operations on the upper region of the abdomen. All authors emphasize the length of the anæsthesia and the remarkable muscular relaxation. The opinions as regards after-effects vary greatly. While most authors report but rare cases of vomiting and cephalalgia, these after-effects have been observed more frequently by operators who have had little experience of the method. Three fatal cases have been reported in connection with the anæsthesia. We are, however, not justified in considering them as representing the percentage of the mortality resulting from the method, because in one case as much as 18 c.c. were injected; it was consequently a very high anæsthesia (Dikshit), to which a greater risk of fatal issue is always attached. Dikshit is the only author who injected 18 c.c.

All the other authors have used for upper abdominal surgery up to an average of 15 c.c., i.e. a maximum of 18 c.c. The two other fatal cases took place in connection with a partially successful hemianæsthesia in the lateral position and as a consequence of kidney operations, i.e. under special conditions (Wybauw). The method is not to be recommended for the lateral position and hemianæsthesia.

Experience has proved that the dose of 18 c.c. exceeds the limit of safety, and that the details of the technique cannot be modified without danger; as a matter of fact, if modifications are introduced, it is no longer the method of Jones.

The object of our experiments was to investigate the superiority which is claimed for the Jones method and to determine its use for gynæcological operations. After having carried out ten anæsthesias with a thick needle and doses ranging from 8 to 12 c.c. we kept to 10 c.c. for all gynæcological operations, using exclusively very thin needles. We used the percaine solution 1:1500 in 0.5 per cent saline. The patients were anæsthetized in the lateral decubitus on the stretcher, whereupon they were placed for six minutes in the ventral position. They were then cautiously conveyed to the operating table without jolting, the upper part of the body being maintained at a lower level than the pelvis, and the table being in the slight Trendelenburg position. Contrary to Jones's routie, we always gave the patients a narcotic. For the sake of comparison certain patients were given therapeutic agents as a prophylactic measure to combat the fall of blood-pressure, while others did not receive this treatment. We wish to emphasise the fact that it is important for the success of spinal anæsthesia to follow exactly all the details of the details of the technique. The stabilization of the physiological conditions in the spinal canal, the reliability of the action and the absence of undesirable accidents depend on the exactess with which all the details of the techique are carried out.

Before going into detail let us consider the results of our experiments in 250 consecutive cases in which the blood-pressure was registered every three to five minutes before and during the anæsthetic (Table I).

TABLE I.

| | | | |
|---|---|---|---|
| Failures ... ... ... | 2 | 0.8% | Technique not irreproachable (2 c.c. were withdrawn with a view to percaine analysis). |
| Insufficient ... ... | 7 | 2.8% | $N_2O+O_2$ + ether were necessary. |
| Sufficient, but psychical failures ... ... | 20 | 8.0% | Administration of $N_2O+O_2$ (the patients being excited, exhibiting psychical troubles or nausea) either immediately or after 1¼ to 1½ hours. |
| Very good ... ... ... | 221 | 88.4% | |
| | 241 | 96.4% | |
| Accidents ... ... ... | none | | |
| Headache ... ... ... | 8 | 3.2% | The patients got up between the 6th and the 10th day. Headache for 2 to 5 days which was successfully treated with short-wave diathermy of the head. |

The operation consisted exclusively of laparotomies. They were important interventions or combined operations requiring a maximum of relaxation and an anæsthesia of long duration. There were amongst them 112 extirpations of the uterus with or without the adnexes, 61 serious operations on the adnexes, 77 laparotomies with antefixation of the uterus, appendectomies, hernias, tubal sterilizations, combined with colporrhaphies and plastic operations.

This shows that the method gives excellent results. The relaxation is very good; the operations lasted from one to two hours. The above-mentioned patients were easily put to sleep with 50 to 70 per cent $N_2O$, the relaxatoin being perfect. The questions which we intended to solve were:

1. Is the prophylactic treatment of the fall of the blood-pressure possible, and what should this treatment be?
2. Must one give up the "twilight sleep"?
3 (*a*) Is Jones's contention correct when he states that by

its progressive dilution, such as apparently takes place through its rising into the spinal canal, the percaine solution becomes weak enough to be no longer dangerous when reaching the medulla oblongata?

3 (*b*) Is the assertion of several authors correct when they state that the anæsthetic agent brought into contact with the medulla oblongata causes no paralysis of the respiratory centre, but only circulatory troubles with brain anæmia and secondary respiratory troubles?

I. As a prophylactic measure, to combat the fall of the blood-pressure, Jones gives 1 c.c. ephetonine after the spinal anæsthesia. The opinions of the other authors as to the prophylactic treatment of the fall of blood-pressure differ greatly. The literature shows that certain of them reject it as being useless, others state that it is only active when injected prior to the anæsthesia, others again when injected simultaneously with the anæsthetic agent, and there are authors who assert that the best action is exhibited when it is administered ten minutes after the spinal injection. The opinions of the authors differ, too, as regards the choice of the therapeutic agent, the value of adrenalin or epetonine being specially discussed. In view of the considerable importance of the blood-pressure for the safety of spinal anæsthesia, we have carried out series consisting each of 40 operations as similar as possible, i.e.:

1. Without any vascular medication.
2. With subcutaneous adrenalin injection (1 c.c. solution, 1:1000) five to ten minutes before the spinal injection.
3. With ephetonine (1 c.c. intramuscularly) simultaneously with the spinal injection.
4. With ephetonine five to ten minutes before the spinal injection.

In all these cases the blood-pressure was registered at intervals of three to five minutes, the measuring apparatus remaining in position. Table II shows the average of the initial blood-pressure level, i.e. before the beginning of the anæsthesia or of the administration of the prophylactic agent, the average of the lowest level during anæsthesia and the average at the end of the operation. The number of cases showing the fall below 100 and even below 80 mm.

Hg. in every series is impressive. A comparison of the figures shows the unfavourable conditions when no prophylactic treatment is used. With an initial value of 120/70 Riva-Rocci a minimal of 75/45 RR. has been attained, and the end-figure is but 80/50 RR. In 35 cases the blood-pressure fall below 100 mm. Hg. and in 15 cases below 80 mm. Hg. Following the subcutaneous injection of 1 c.c. adrenalin solution 1 : 1000 the blood-pressure fell 35 times below 100 mm. Hg., and 13 times below 80 mm. Hg. When administering 1 c.c. of ephetonine intramuscularly simultaneously with the spinal injection, the blood-pressure fell 31 times below 100 mm. Hg. and 12 times below 80 mm. Hg. When ephetonine was given five to ten minutes before the spinal injection, the blood-pressure fell but 21 times below 100 mm. Hg. and six times only below 80 mm. Hg.

TABLE II.

| 40 cases of each of the following groups | Average of the initial level | Average of the deepest level | Average of the final level | Pressure-fall under 100 mm. Hg. | Pressure-fall under 80 mm. Hg. |
|---|---|---|---|---|---|
| (*a*) Spinal anæsthesia without prophylactic treatment | 120/70 | 75/45 | 80/50 | 35 | 15 |
| (*b*) Before the operation 1 c.c adrenalin solution 1 : 1000 subcutaneously ... | 125/70 | 85/50 | 100/60 | 35 | 13 |
| (*c*) Ephetonine simultaneously with spinal injection | 130/75 | 85/55 | 95/60 | 31 | 12 |
| (*d*) 1 c.c. ephetonine intramuscularly 5 to 10 minutes before the spinal injection ... ... | 125/75 | 95/60 | 105/60 | 21 | 6 |

This condition, considered from a pharmacological point of view, is not surprising in view of the vascular innervation and of the points of attack of ephetonine and of spinal anæsthesia. If the peripheral vasoconstrictor nerves are stimulated prior to the spinal anæsthesia, the paralysis of the vascular regulation which may result from spinal anæsthesia can no longer develop to the full extent its paralysing effect on the vessels. If, on the other hand, the most important centres have already exerted a paralysing action on the direct vascular innervation, adrenalin and ephetonine are no longer able to counteract the paralysis.

(*To be continued.*)

## ASSOCIATION OF ANÆSTHETISTS OF GREAT BRITAIN AND IRELAND.

THE Third Annual General Meeting of the Association was held at the rooms of the Medical Society, Chandos Street, on October 31st last, at 8.30 p.m.

Present: Dr. H. W. Featherstone (in the chair), the Vice-President, Treasurer, Honarary Secretary, and about thirty members.

Messrs. Greaves, Richards, Crampton and Ashworth were the new officers elected to take the place of Messrs. Boyle, Falkner Hill, Flemming, and Hughes, the retiring members of the Council. Messrs. Faraker, MacVean, and Pleasance were elected members of the Association. Dr. G. F. V. Anson, of New Zealand, and Dr. G. Brown, of Autsralia, were elected corresponding members.

Dr. Mennell stated that he had written to the Permanent Under-Secretary of State in connection with the question of coroner's inquests and that his letter had been forwarded to one of the Permanent Assistant Under-Secretaries of State at the Home Office. He then described an interview he had had there with two Assistant Under-Secretarise, in which he had pointed out the feelings of the Association on the subject of coroner's inquests: both men had appeared interested and sympathetic. The sub-committee had now forwarded a copy of their suggestions to the Home Office, to be sent to the Ministry of Health. These suggestions were put to the discussion of the meeting.

The Treasurer presented his report for the financial year ending June 30th, 1934. This showed a balance of £260 17s. 10d. Two members whose subscriptions were more than one year in arrear ceased to be members under Rule 10.

The report was proposed, seconded, and received.

The Treasurer proposed that the donation of five guineas given to the R.M.B.F. should now become an annual subscription. This was duly seconded and passed.

The report of the Diploma Sub-Committee had been circulated to members, and when the subject was opened for discussion, a few suggestions for alterations were put forward.

The President read his report, of which the following is a brief summary:—The much-discussed problem of payment for the anæsthetists of surgical units has shown itself to be typical of the large proportion of our problems. We have secured publicity and a great deal of help and encouragement from the surgeons and others who are affected, but the interweaving of interests between the hospitals, the medical school, and the University of London is so complicated that we find difficulty in discovering the responsible body upon whom to exert pressure. The Dean of St. Bartholomew's has helped us as much as possible, but the matter is now being held up until the Grants Committee have replied to the requests addressed to them.

The question of salaries for anæsthetists to the London County Council Hospitals has developed along lines which in certain respects are satisfactory. The fees paid by the L.C.C. to the Panel of Anæsthetists, I understand, have now been raised to two guineas per session of two and a half hours. Last month a letter was received from Sir Frederick Menzies, the Chief Medical Officer of Health for the London County Council. He enquired whether our Association had expressed any views as to the appropriate salaries to be paid to (*a*) whole-time anæsthetists, and (*b*) part-time anæsthetists, and also if there were any conditions of service, such as the question of holiday leave, upon which our Association had expressed any opinion. We decided to reply in somewhat general terms as follows: (*a*) For whole-time anæsthetists living in the hospital, the salaries of the anæsthetists to be the same as for the other specialists with whom they work. (*b*) We recommend that two and a half guineas should be paid for each session of not more than two hours' duration, and one guinea for every hour or part of an hour afterwards. We suggested that owing to the nature of the employment the period of holidays should be ample, and that at least six weeks in the year should be allowed. It was remarked that these observations were put forward in the belief that a service of trained anæsthetists was contemplated.

In the discussion on coroner's inquests, it was pointed out that we have no desire to suppress investigation, but the present nature of the enquiry is wrong. A properly trained pathologist should perform the examination, the clinical notes and reports should be available for him, and proper conclusions should be drawn from the facts at a conference between the pathologist and the clinical officers responsible in the case together with other independent experts. Often pubilc enquiry could then be dispensed with, provided the relatives were satisfied. At present, it often happens that the relatives were alarmed and worried quite unnecessarily, and there is unpleasant publicity. An important protest concerning the serious loss of time involved for anæsthetists who have to give evidence in these enquiries has been ventilated in public recently by one of our Council.

Dr. Minnitt has raised the question of the anæsthetist cooperating with the British College of Obstetricians and Gynæcologists in the enquiry into anæsthetics for "domestic" midwifery. Attention is being paid to this matter.

The Dean of the Post-Graduate Medical College, in answer to a suggestion that a Department of Anæsthetics should be instituted along complete modern lines, returned a courteous and interested reply.

In accordance with the resolution of the last general meeting the President of the Royal College of Surgeons of England was approached with regard to a Diploma in Anæsthetics. The Council of the College appointed a committee comprised of the President, the two Vice-Presidents, Mr. Victor Bonney, and Mr. Hugh Lett, to confer on the question. Dr. Blomfield, Dr. Hadfield, Dr. Magill and myself, will meet this committee on Friday next. In the meantime Dr. Morris has received a lettter from Mr. Wilfred Trotter, one of the Vice-Presidents of the College, expressing his interest and assuring us of the general support of the Council in this matter.

Finally, I have to state that a list of the officers and members of this Association will be printed and circulated in the near future.

## ABSTRACTS.

*Obstetric analgesia with rectidon.* E. SCHEHL *in Schuerz, Merk-Anæsth.* November 1934, p. 57.

Rectidon is another barbituric acid derivative. It has been employed as a suppository or as an enema for combating the pains of labour. The results appear to have been moderately satisfactory, a considerable proportion of the patients having been very excited or restless, although they had afterwards no recollection of this. Effects as regards progress of labour, blood loss, condition of infant at birth were all good. The author used it also in conjunction with pernocton when the effects were more certain and profound. In the same number, on page 70, is an article on the use of evipan for operations on the eye. No large number of cases is quoted, but the writer found evipan narcosis admirable for many eye operations. As a rotuine he prefers to use it in association with a local analgesic.

*Cyclopropane anæsthesia.* H. R. GRIFFITH in *Canad. Med. Journ.,* August, p. 157.

The author records 350 administrations, of which 206 were for abdominal operations. In these addition of ether was neded in less than 5 per cent. For reduction of fractures it gave relaxation in the strongest workmen without preliminary medication. In Cæsarean sections and forceps cases cyclopropane gave the best possible results. The average amount of the gas used in the author's cases was 1.79 gallons per case. The cost was 50 cents a gallon. It was, of course, used with $CO_2$-absorption, and in a strength of about 10 to 15 per cent For major surgery it was preceded by small doses of avertin. When this was not employed nembutal was given beforehand. Results both on the table and after were uniformly satisfactory, and the only objection the author urges against cyclopropane is increased superficial

bleeding which he attributes to some effect on the vasomotor control of arterioles.

Waters and Schmidt (*Journ. Med. Assoc.*, September 19, pp. 97 to 983) give an account of the physical properties of cyclopropane. They further discuss the absorption and elimination of the gas, and state that the normal individual is unaffected by percentages lower than 3.5. They investigated the blood chemistry of patients during and after cyclopropane inhalation, and generally speaking were able to show little deleterious effect. The post-mortem examination of patients who died after operation showed the cyclopropane to be in no case the cause of death, and histologically, except for hyaline degeneration of heart muscle in one or two instances, the gas is shown to be innocuous to the tissues of the body. Vomiting after cyclopropane is more frequent than after nitrous oxide, and the authors believe that the latter should be chosen for short operations and when relaxation is unimportant, but for most major surgery they are more and more adopting cyclopropane as their first choice for general anæsthesia.

*Studies in subarachnoid anæsthesia.* F. W. Cotui, in *Anæsth. and Analg.*, Sept.-Oct., p. 191.

The conclusions which are arrived at by this investigator are remarkable chiefly for the difference which they show between the facts established by clinical observation and the opinions which the author forms from his experiments. For example, while clinical workers have long recognized the value as regards safety of the Trendelenburg position during spinal analgesia, this experimenter concludes that it is not only useless but harmful. He finds blood transfusion of little use in treating shock, and that vomiting associated with spinal anæsthesia is probably caused by stimulation of the vomiting centre by the drug which has spread from the spinal canal. With regard to the low blood-pressure that is so often detrimental to spinal analgesia, the author offers no explanation, merely remarking that it has the main features of shock. The same journal publishes at page 192 an excellent article on the organization

and management of a department of anæsthesia in a hospital of 200 to 400 beds.

*The physiology of respiration in parturition.* R. M. McCORMICK, *ibid.*, page 211.

This article gives some remarkable evidence of the value of $CO_2$ as a preventive and cure of post-partum hæmorrhage, and also in the treatment of eclampsia. The author has employed the gas for two years as a prophylactic in parturition, giving it immediately after delivery, and is convinced of its efficacy in maintaining uterine tone.

*Clinical observations on the use of evipan.* K. M. HEARD, in *Canad. Med. Assoc. Journ.*, December 1934, p. 617.

The author has not had wide experience of the drug, but emphasises most of the points—slow injection, control of dose by symptoms, etc.—which have been made by previous writers. He points out the value of evipan to control the convulsions of tetanus, and gives details of an illustrative case.

## REVIEW.

*Anæsthesia in labour.* KATHERINE LLOYD WILKINSON, M.D. pp. 96. Price 5s. Ed. Arnold. London, 1934.

The writer, rightly in our opinion, lays stress on the fact that it is in the early stages of labour that more relief is necessary than is usually provided. This applies especially to primiparæ. As Dame Louise McIlroy points out in a foreword, the problem of defining the measures for relief which may be employed by midwives in their practice has not yet found a satisfactory solution. We regret that the writer of this little book has not given attention in it to this problem, which is the most urgent practical one in connexion with obstetrics, taking into account the great proportion of confinements which are conducted without the aid of a medical man. The book is divided into chapters which deal with the three stages of labour, with abnormal deliveries, and with analgesics and anæsthetics in complicated labour. For the early part of the first stage the author approves of bromide and chloral. All the commonly used drugs and methods, including the various barbiturites, are concisely discussed, and this applies to the management of the later stages. The book, in fact, provides an excellent summary of the current methods of procuring anæsthesia in labour, without showing a marked individual preference for any one particular procedure. There is also an excellent account of measures necessary for resuscitation of the newly born. Apparatus is freely illustrated.

## CORRESPONDENCE.

"Bradlaugh," 380 Manning Road, Durban.
26th November, 1934.

To the Editor.

Dear Sir,—Will you kindly inform me whether there is any institution in the British Isles at which a Diploma in Anæsthesia may be obtained. I did notice some months ago that the Association of Anæsthetists of Great Britain and Ireland had appointed a sub-committee to deal with the question. I have, however, seen no further report of the sub-committee.

I hope I am not putting you to too much trouble in asking you for this information.

Yours faithfully,
H. GRANT-WHYTE.

[We have informed our correspondent that negotiations are in being, but that at present there is no Diploma of the sort in existence.—Ed.]